

APRIL/MAY 2023

**GPH12/DPH12 — CLASSICAL AND
STATISTICAL MECHANICS**

Time : Three hours

Maximum : 75 marks



SECTION A — ($10 \times 2 = 20$ marks)

Answer ALL questions.

1. Write Hamilton's variational principle.
2. Why are Poisson brackets useful?
3. What is the advantage of using action-angle variable?
4. State Kepler's laws of motion.
5. Define moment of inertia tensor.
6. What do you understand by precession?
7. Define thermodynamic potential.
8. What do you understand from Sackur-Tetrode equation?
9. What do you mean by Bose-Einstein condensation?
10. Write a short note on thermionic emission.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) For linear harmonic oscillator, use Hamiltonian principle to obtain its equation of motion.

Or

- (b) State and Prove D'Alembert's principle.
12. (a) Derive Hamilton's Jacobi equation.

Or

- (b) Discuss the general theory of small oscillations.
13. (a) Derive and discuss Euler's angle for rigid body.

Or

- (b) Derive Euler's Equation of motion.
14. (a) Write a short note on
- (i) Random walk
- (ii) Brownian motion

Or

- (b) What is meant by an ensemble? Classify ensembles.

15. (a) Distinguish between Fermi-Dirac and Bose-Einstein statistics.

Or

- (b) Explain Paul's theory of paramagnetism.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Prove that Poisson's brackets are invariant under canonical transformation.
17. Using the method of small oscillations, calculate the frequencies of vibrations of a linear triatomic molecule.
18. Discuss the theory of a spinning symmetrical top under gravity.
19. Discuss Maxwell Boltzmann distribution law.
20. Derive Planck's law of radiation and discuss its limitation.